

**EXHIBIT 14
TO DETROIT EDISON'S
OPPOSITION TO
PLAINTIFF'S MOTION
FOR PRELIMINARY
INJUNCTION**

UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF MICHIGAN

UNITED STATES OF AMERICA,

Plaintiff,

And

NATURAL RESOURCES DEFENSE
COUNCIL, INC. AND SIERRA CLUB,

Proposed Intervenor-Plaintiffs,

v.

DTE ENERGY COMPANY AND
DETROIT EDISON COMPANY,

Defendants.

Civil Action No.
2:10-cv-13101-BAF-RSW

Judge Bernard A. Friedman

Magistrate Judge R. Steven Whalen

DECLARATION OF STANLEY R. HAYES

I, Stanley R. Hayes, declare as follows.

1. At the request of counsel for Defendants (collectively, "Detroit Edison") and with the assistance of ENVIRON staff under my direction and with reference to the declaration of Mr. Ralph Morris (Morris 2010), I have evaluated Plaintiff's estimates of the fine particulate matter (PM_{2.5}) air quality effects of, and the health impacts alleged to be associated with, "excess emissions" from Unit 2 of the Monroe Power Plant, the unit at issue in this case. Those alleged excess emissions of sulfur dioxide (SO₂) and nitrogen oxides (NO_x) are the focus of Plaintiff's motion for preliminary injunction.¹

2. In conducting this evaluation, I reviewed the declarations of Plaintiff's experts Mr. Lyle Chinkin (Chinkin 2010) and Dr. Joel Schwartz (Schwartz 2010). In addition, I reviewed and consulted technical references and documents prepared by the U.S.

¹ I have not evaluated and do not express an opinion regarding the validity of Plaintiff's calculation of alleged "excess emissions" at issue in this case. For purposes of this declaration only, I base my opinions on Plaintiff's estimates of such alleged "excess emissions," and I will use that phrase here for convenience and consistency with Plaintiff's declarations.

Environmental Protection Agency (USEPA) and others regarding issues relevant to this case. Below, I provide a summary of my conclusions, the facts, documents, and communications that support my opinion, and the bases and reasons for my opinions and other data or information I relied on in forming my opinions. A list of references can be found in the attached reference list.

3. My evaluation has been done in response to declarations prepared in support of Plaintiff's motion for preliminary injunction. To the extent additional material is presented to me, I may have additional views based upon such material. As such, I reserve the right to add to or amend my analyses and the opinions stated in this declaration, and to supplement them later as necessary and appropriate.

I. QUALIFICATIONS

4. I am an engineer and a Principal with ENVIRON International Corporation. ENVIRON is a scientific consulting firm specializing in environmental matters, with offices throughout the United States and elsewhere. I have performed air-related research consulting for more than thirty years, since 1976. One of my primary areas of expertise is the evaluation of air-related environmental impacts of emissions from industrial facilities and other sources, such as are at issue in this litigation. I have performed numerous assessments of the impact of such sources on air quality and public health risk and related air monitoring and meteorological data analysis, interpretation, and interpolation, as well as emission estimation, air quality modeling, model performance evaluation, and exposure assessment.

5. I am the primary author of more than sixty scientific papers and presentations and several hundred technical reports on air-related subjects. I have provided expert testimony in court and before federal, state, and local regulatory agencies, including the U.S. Science Advisory Board's Clean Air Scientific Advisory Committee, the California Air Resources Board, the South Coast Air Quality Management District (Los Angeles area), and the Bay Area Air Quality Management District (San Francisco area). I have given invited scientific briefings to members of the California legislature and political leaders elsewhere in the U.S.

6. I am a Fellow of the Air & Waste Management Association (A&WMA), an 8,000-member international scientific association for air quality and waste management professionals. For A&WMA, I co-chaired national specialty conferences on climate change, greenhouse gas reporting, and homeland security. I am an elected member of the Board of Directors of A&WMA's Golden West Section. I chaired the Inter-Committee Task Force on Environmental Security (ITF-9) and a national technical committee (EE-1, Health Effects and Exposure). I am vice chair of a national technical committee on climate change (ES-5, Climate Change Management Strategies), and I am a member of national technical committees on the advancement and use of air dispersion modeling (AB-3, Meteorology) and risk assessment (EE-5, Risk Assessment / Management). I chaired the A&WMA Technical Council's Effects Division of which EE-1 and EE-5 are a part. I also served on the editorial review board of A&WMA's *EM* monthly environmental management publication.

7. I am a member and past chair of the Advisory Council of the Bay Area Air Quality Management District, which advises the Board of Directors and senior staff of the district on matters of air pollution science and policy. I have served as a member of the Advisory Council from 1995-2007 and from January 2009 to the present, chairing at various times the Executive, Technical, and Air Quality Planning Committees.

8. A copy of my resume, which contains a list of my scientific papers and presentations, is provided as Attachment A. A list of my prior deposition and court testimony is in Attachment B. ENVIRON is being compensated for my services in this matter at the rate of \$275/hour.

II. SUMMARY OF OPINIONS

9. As a result of my review and evaluation of the material described above, I have developed the following opinions.

10. Opinion 1 – Emissions from Monroe Unit 2 have not increased since re-start of the unit.

Opinion 1a. Changes to Monroe Unit 2 have not increased emissions over levels prior to those changes, and thus have not caused air quality or health impacts to increase.

Opinion 1b. Cumulative effects of PM_{2.5} differences in ambient air from alleged excess emissions since Monroe Unit 2 re-start are smaller than estimated by Plaintiff, likely by a wide margin.

11. Opinion 2 – Plaintiff's estimates of PM_{2.5} differences in ambient air attributed to alleged "excess emissions" are small relative to many PM_{2.5} air quality benchmarks.

Opinion 2a. Plaintiff's estimates of PM_{2.5} differences in ambient air are a small percentage of ambient PM_{2.5} levels.

Opinion 2b. Plaintiff's estimates of PM_{2.5} differences in ambient air are many times smaller than the concentration levels of health-based PM_{2.5} air quality standards.

Opinion 2c. Plaintiff's estimates of PM_{2.5} differences in ambient air are smaller than significance levels used by USEPA in its proposed Transport Rule.

Opinion 2d. Plaintiff's estimates of PM_{2.5} differences in ambient air from alleged excess emissions are smaller than USEPA's recently-adopted annual PM_{2.5} Significant Impact Levels (SILs) everywhere in the region modeled and are smaller than the most applicable 24-hour PM_{2.5} SIL on nearly every day modeled, in nearly every grid cell.

12. Opinion 3 – Plaintiff's health impact estimates are not reliable.

Opinion 3a. Premature mortality estimates of Plaintiff's expert Dr. Schwartz are calculated using an overly simplified approximation that relies on outdated methods and unsupported assumptions; further, because they are not based on state-of-the-science modeling of the material facts of this case, his estimates are not reliable.

Opinion 3b. Premature mortality estimates of Dr. Schwartz rely on incomplete and outdated representations of atmospheric transport and chemistry that have serious and acknowledged technical shortcomings, and thus his estimates are not reliable.

13. Opinion 4 – Additional material uncertainties are present in Plaintiff's estimates.

Opinion 4a. Uncertainty is caused by Plaintiff's reliance on modeling done using atypically adverse 2005 meteorological data to estimate PM_{2.5} differences.

Opinion 4b. Uncertainty is caused by Plaintiff's failure to account for the physical effects on stack plume dispersion of emission control equipment, thus causing PM_{2.5} differences from alleged excess emissions to be overstated.

Opinion 4c. Uncertainty is caused by Plaintiff's analysis approach, resulting from such factors as inherent limits on the accuracy of air quality models and use of linear scaling of Particulate Matter Source Apportionment Technology (PSAT) modeling results.

14. Opinion 5 – Excess emission comparisons are misleading.

Opinion 5a. Plaintiff's emission-based comparisons of alleged excess emissions to other sources of SO₂ and NO_x emissions into ambient air are misleading because they do not account for comparative effects on air quality.

Opinion 5b. Plaintiff's emission-based comparisons of alleged excess emissions to other sources are misleading because, among other things, they do not account for important differences among sources.

III. BASES OF OPINIONS

15. Plaintiff argues that impacts of alleged excess emissions from Monroe Unit 2 pose a “stark public health harm” (DOJ 2010, at 13) and thus warrant the Court’s granting their motion for preliminary injunction. In weighing the urgency of the preliminary injunction sought by Plaintiff, it is reasonable and relevant to consider whether increases in emissions have occurred since re-start of Monroe Unit 2, to assess accuracy and reliability of estimates made by Plaintiff’s experts, and to compare those estimates to reasonable and commonly used benchmarks of air quality significance as follows.

Opinion 1 – Emissions From Monroe Unit 2 Have Not Increased Since Re-start Of The Unit

Opinion 1a. Changes To Monroe Unit 2 Have Not Increased Emissions Over Levels Prior To Those Changes. And Thus Have Not Caused Air Quality Or Health Impacts To Increase

16. Data from continuous emission monitoring systems (CEMS) are available at both plant and individual unit levels from USEPA’s Clean Air Markets data and maps website (see camddataandmaps.epa.gov/gdm/). Using that website, monthly and daily CEMS data for the Monroe Power Plant were extracted for the period January 2009 through June 2010 (the last month for which such data were posted). Monthly data for July 2010 not yet posted on the USEPA website were obtained from Detroit Edison. Figure 1 shows *monthly* SO₂ and NO_x emissions for all plant units (top graph) and Monroe Unit 2 (bottom graph). Figure 2 shows Monroe Unit 2 *daily* emissions for SO₂ (top graph) and NO_x (bottom graph) from January 1 through June 26, 2010 (daily July data were not available at the time this declaration was prepared).

17. Monroe Unit 2 was down for the changes at issue in this case from mid-March to early June. As shown in the top graph of Figure 1, plant-wide SO₂ emissions in July 2010, after Unit 2 re-start in June, were less than in February 2010, prior to Unit 2 shut down, and less than SO₂ monthly emissions prior to that time back to January 2009 (the earliest month examined). Plant-wide NO_x emissions in July 2010 were less than NO_x monthly emissions in February 2010, prior to Unit 2 shut down. Figure 2 shows that daily emissions of SO₂ and NO_x from Monroe Unit 2 after Unit 2 resumed normal

operations were similar to or less than daily emissions during normal operations before Unit 2 was shut down.

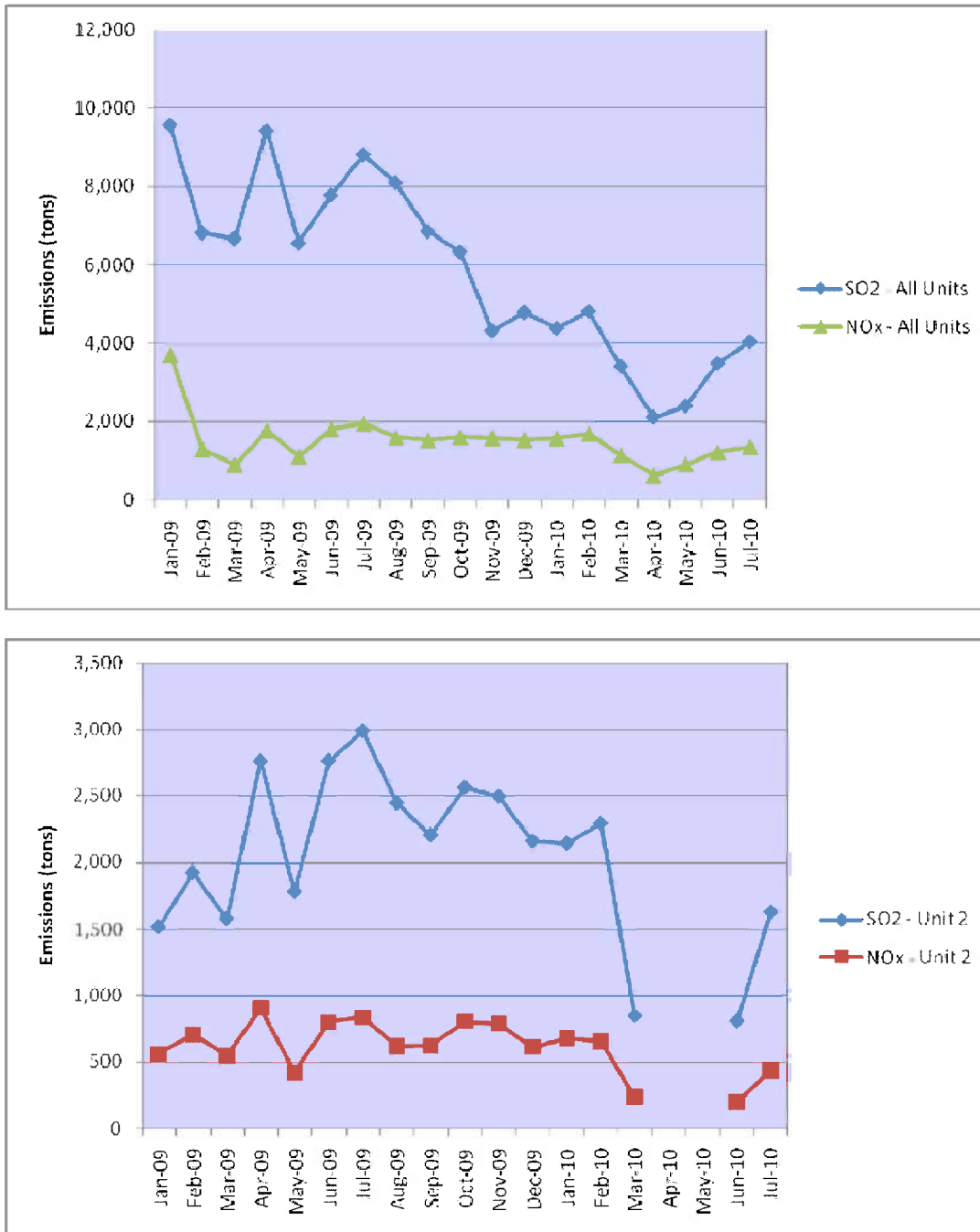


Figure 1. Monthly SO₂ and NO_x CEMS emissions from Monroe Power Plant (top graph) and Monroe Unit 2 (bottom graph) from January 2009 through July 2010

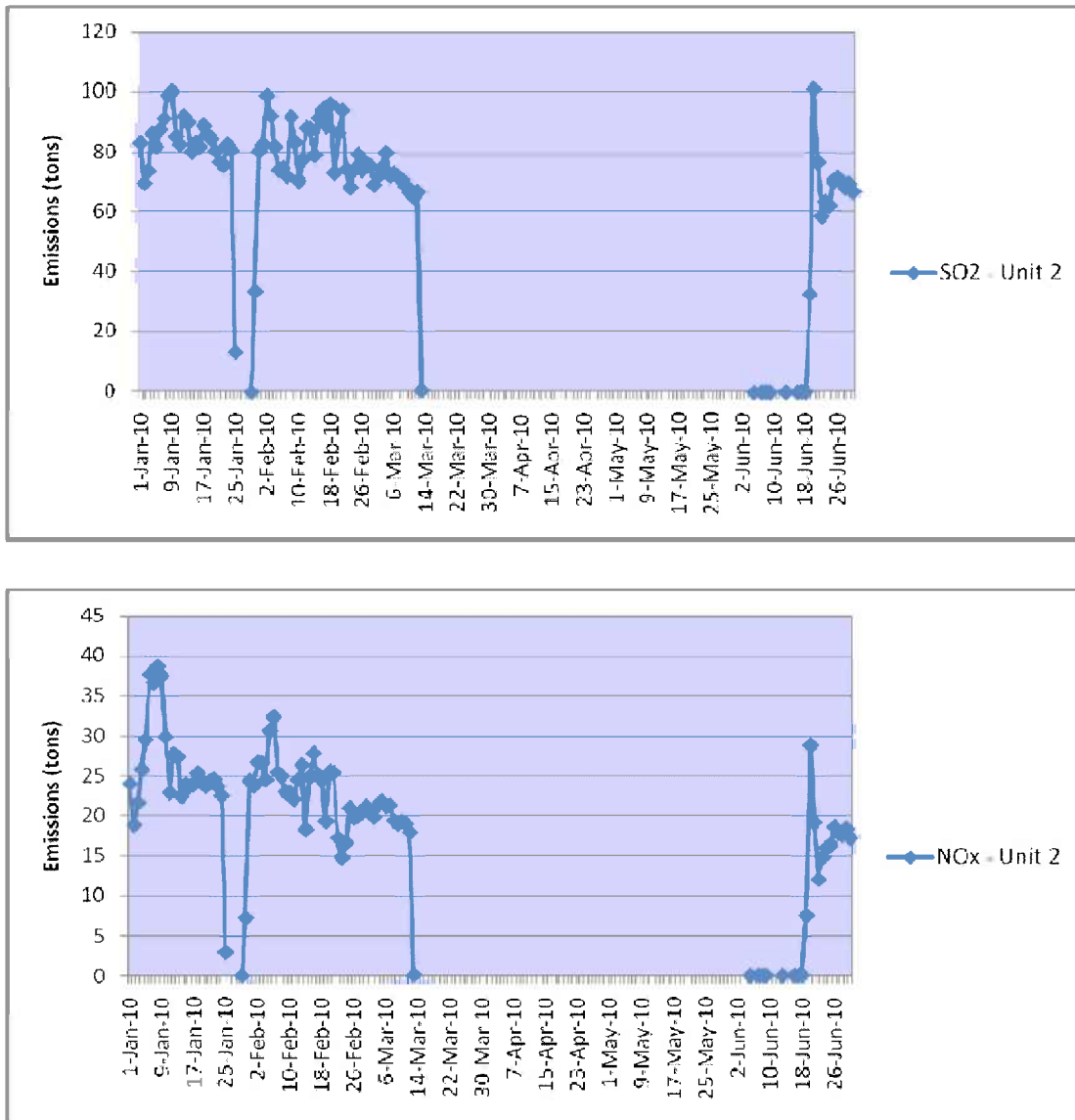


Figure 2. Daily SO₂ and NO_x CEMS emissions from Monroe Unit 2 from January 1 through June 26, 2010 (top graph – SO₂, bottom graph – NO_x)

Opinion 1b. Cumulative Effects Of $PM_{2.5}$ Differences in Ambient Air From Alleged Excess Emissions Since Monroe Unit 2 Re-Start Are Smaller Than Estimated By Plaintiff. Likely By A Wide Margin

18. Plaintiff's expert Mr. Chinkin estimated $PM_{2.5}$ air quality impacts of alleged excess emissions on an annualized basis, as if those emissions had occurred continuously for a full year. Similarly, Plaintiff's expert Dr. Schwartz estimated health impacts of alleged excess emissions as if those emissions had occurred for a long period.

19. However, Monroe Unit 2 was re-started just several months ago in June 2010. Thus, cumulative effects of any $PM_{2.5}$ differences in ambient air and associated health impacts from alleged excess emissions that might have occurred since Monroe Unit 2 re-start are less than estimated by Mr. Chinkin and Dr. Schwartz, likely by a wide margin.

Opinion 2 – Plaintiff's Estimates Of $PM_{2.5}$ Differences in Ambient Air Attributed To Alleged "Excess Emissions" Are Small Relative To Many $PM_{2.5}$ Air Quality Benchmarks

20. In his declaration, Mr. Chinkin estimates the $PM_{2.5}$ differences in ambient air that he attributes to alleged excess emissions. Mr. Chinkin, however, does not compare the magnitude of those differences to commonly used benchmarks of $PM_{2.5}$ air quality significance. Had he done so, Mr. Chinkin would have recognized that his estimated differences are small relative to many of those benchmarks.

Opinion 2a. Plaintiff's Estimates Of $PM_{2.5}$ Differences in Ambient Air Are A Small Percentage Of Ambient $PM_{2.5}$ Levels

21. $PM_{2.5}$ differences in ambient air estimated by Mr. Chinkin from 2005 air quality modeling are a small percentage of $PM_{2.5}$ concentrations measured at air quality monitors in surrounding States that year. Annual $PM_{2.5}$ concentrations measured in 2005 at one hundred thirty ambient air monitoring stations in Michigan and adjacent states of Indiana, Ohio, and Wisconsin were compared to annual $PM_{2.5}$ differences in ambient air estimated by Mr. Chinkin. Note that $PM_{2.5}$ concentrations in recent years are substantially lower than in 2005 (see Opinion 4a).

22. Figure 3 plots both annual $PM_{2.5}$ differences estimated by Mr. Chinkin and annual $PM_{2.5}$ concentrations measured at those monitors for 2005, with the monitor

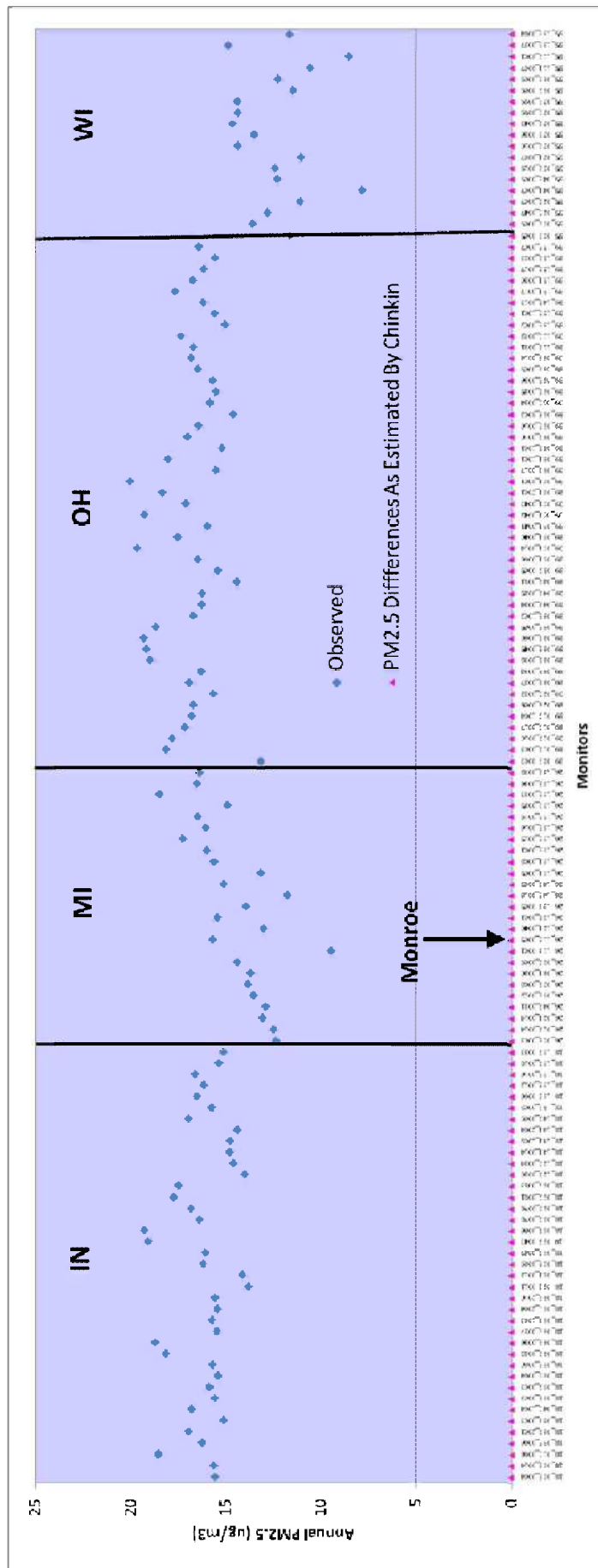


Figure 3. Mr. Chinkin's estimated annual PM_{2.5} differences for 2005 compared to annual PM_{2.5} concentrations measured at monitors in surrounding States (note that PM_{2.5} differences estimated by Mr. Chinkin vary among monitors, though that variation is small relative to the scale of the figure)

in Monroe County indicated. Across the one hundred thirty monitors, the largest contribution of estimated annual PM_{2.5} differences to measured annual PM_{2.5} concentrations at any monitor in those States is 0.29%. The median contribution is 0.11%.

23. The figure shows graphically that PM_{2.5} differences estimated by Mr. Chinkin to result from alleged excess emissions would contribute only a small percentage of the annual PM_{2.5} concentrations measured at these monitors. Note that PM_{2.5} differences estimated by Mr. Chinkin and shown in the figure vary among monitors, though that variation is small relative to the scale of the figure (which is set to allow measured ambient PM_{2.5} concentrations to be shown).

Opinion 2b. Plaintiff's Estimates Of PM_{2.5} Differences In Ambient Air Are Many Times Smaller Than Concentration Levels Of Health-Based PM_{2.5} Air Quality Standards

24. PM_{2.5} differences in ambient air estimated by Mr. Chinkin to result from alleged excess emissions are many times smaller than the concentration levels of health-based primary national ambient air quality standards (NAAQS) for PM_{2.5}, which are benchmarks of acceptably healthy air as established by USEPA. Section 109(b)(1) of the Clean Air Act requires USEPA to set primary NAAQS to protect the public health with an adequate margin of safety. That section states:

National primary ambient air quality standards...shall be ambient air quality standards the attainment and maintenance of which in the judgment of the [USEPA] Administrator ...allowing an adequate margin of safety, are requisite to protect the public health. (42 U.S.C. §7409(b)(1))

25. Since USEPA has established primary PM_{2.5} NAAQS to protect the public health with an adequate margin of safety for even the most sensitive population groups, it follows that the concentration levels of primary standards are reasonable benchmarks against which to compare alleged excess emission PM_{2.5} differences estimated by Mr. Chinkin. USEPA has set two primary PM_{2.5} NAAQS, including a 24-hour standard at a concentration level of 35 µg/m³ and an annual standard at a level of 15 µg/m³.

26. Note that use of primary NAAQS concentration levels as benchmarks is more restrictive than required by the NAAQS. To determine if an area is in attainment

(see 40 CFR §§ 50.10 and 50.13), the $35 \mu\text{g}/\text{m}^3$ level of the 24-hour $\text{PM}_{2.5}$ NAAQS is compared not to the highest 24-hour $\text{PM}_{2.5}$ average, but to the three-year average of the 98th percentile 24-hour averages in each year. For the annual $\text{PM}_{2.5}$ NAAQS, the $15 \mu\text{g}/\text{m}^3$ level of the standard is compared not to the highest annual $\text{PM}_{2.5}$ average, but to the three-year average of individual-year annual averages.

27. Figure 4 compares grid-wide maximum 24-hour $\text{PM}_{2.5}$ differences estimated by Mr. Chinkin to the $35 \mu\text{g}/\text{m}^3$ level of the 24-hour $\text{PM}_{2.5}$ NAAQS (note that federal $\text{PM}_{2.5}$ standards are also used by the Michigan Department of Natural Resources and Environment (MDNRE) for the State of Michigan, see MDNRE *Air Pollution Control Rules*). Comparisons are for the maximum concentration difference in any grid cell in the modeling region. As shown, daily grid-wide maximum 24-hour $\text{PM}_{2.5}$ differences estimated by Mr. Chinkin are many times smaller than the $35 \mu\text{g}/\text{m}^3$ level of the 24-hour $\text{PM}_{2.5}$ NAAQS. The grid-wide maximum $\text{PM}_{2.5}$ difference on any day is 4.2% of the NAAQS level, while the average of the grid-wide maxima over the modeled year is 0.7% of the NAAQS level. Put another way, the highest grid-wide maximum $\text{PM}_{2.5}$ difference estimated by Mr. Chinkin on any day is about 25 times smaller than the NAAQS level, while the average grid-wide maximum $\text{PM}_{2.5}$ difference is more than 100 times smaller.

28. The comparison is similar for annual average $\text{PM}_{2.5}$ concentrations. The grid-wide maximum annual $\text{PM}_{2.5}$ difference estimated by Mr. Chinkin is $0.10 \mu\text{g}/\text{m}^3$, which he calculates would occur in the immediate vicinity of the Monroe Power Plant. This grid-wide maximum annual $\text{PM}_{2.5}$ difference is 0.7% of the $15 \mu\text{g}/\text{m}^3$ level of the annual $\text{PM}_{2.5}$ NAAQS, or more than 100 times smaller than the NAAQS level.

Opinion 2c. Plaintiff's Estimates Of $\text{PM}_{2.5}$ Differences in Ambient Air Are Less Than Significance Levels Proposed By USEPA In Its Proposed Transport Rule

29. In its recent Transport Rule proposal (USEPA 2010a), USEPA proposed to define a State's contribution as significant if the impact of its SO_2 and NO_x emissions on downwind nonattainment and maintenance monitors in 2012 would exceed 1% of the NAAQS. If promulgated as proposed, USEPA would thus define a State's contribution to be significant if its emissions would cause the annual $\text{PM}_{2.5}$ design value in 2012 (that is, three-year average of annual mean $\text{PM}_{2.5}$) to increase by more than $0.15 \mu\text{g}/\text{m}^3$ or the

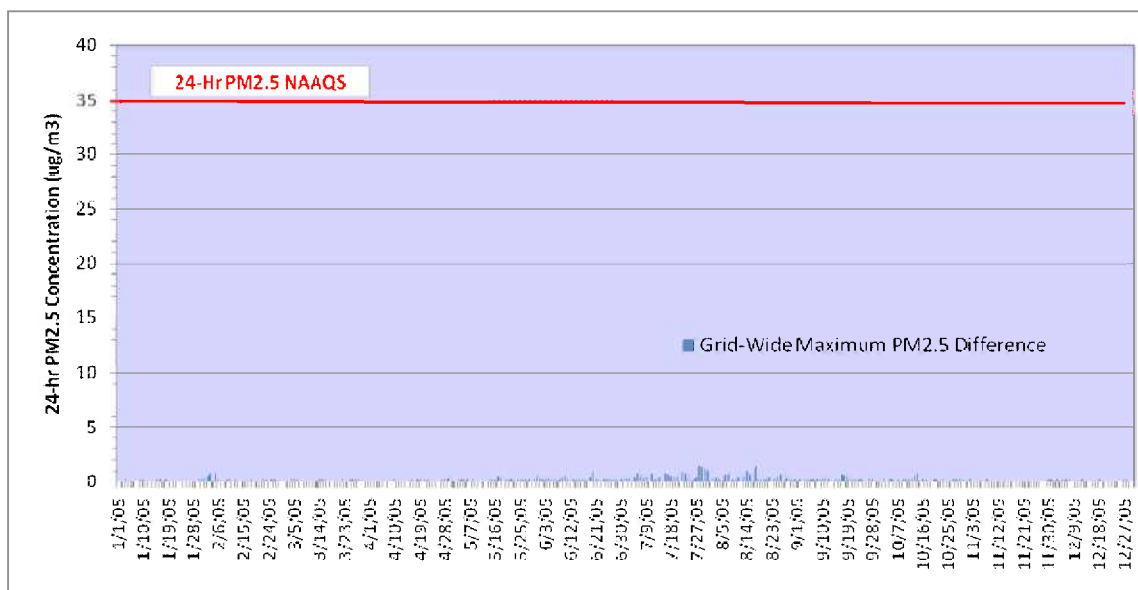


Figure 4. Comparison of daily grid-wide maximum 24-hour $PM_{2.5}$ differences estimated by Plaintiff to concentration level of 24-hour $PM_{2.5}$ NAAQS

24-hour $PM_{2.5}$ design value (that is, three-year average of 98th percentile 24-hour $PM_{2.5}$) to increase by more than $0.35 \mu\text{g}/\text{m}^3$.

30. As described in the air quality modeling technical support document for the proposed Transport Rule (USEPA 2010b), USEPA estimated future-year $PM_{2.5}$ design values using past-year monitoring data and relative future-year changes calculated by air quality modeling. Future-year annual and 24-hour $PM_{2.5}$ design values were calculated using a procedure known as the Speciated Modeled Attainment Test (SMAT), as implemented in a computer program referred to as the MATS software tool (USEPA 2008b).

31. For this declaration, the MATS software tool was used to calculate the effect that Mr. Chinkin's estimated $PM_{2.5}$ differences would have on design values (as determined by MATS) at $PM_{2.5}$ monitors in Detroit, Indianapolis, Cleveland, Dayton, Columbus, and Cincinnati. Figure 5 compares those design value changes to 1% of the relevant $PM_{2.5}$ NAAQS. In all cases, design value changes are less than the 1% NAAQS level.

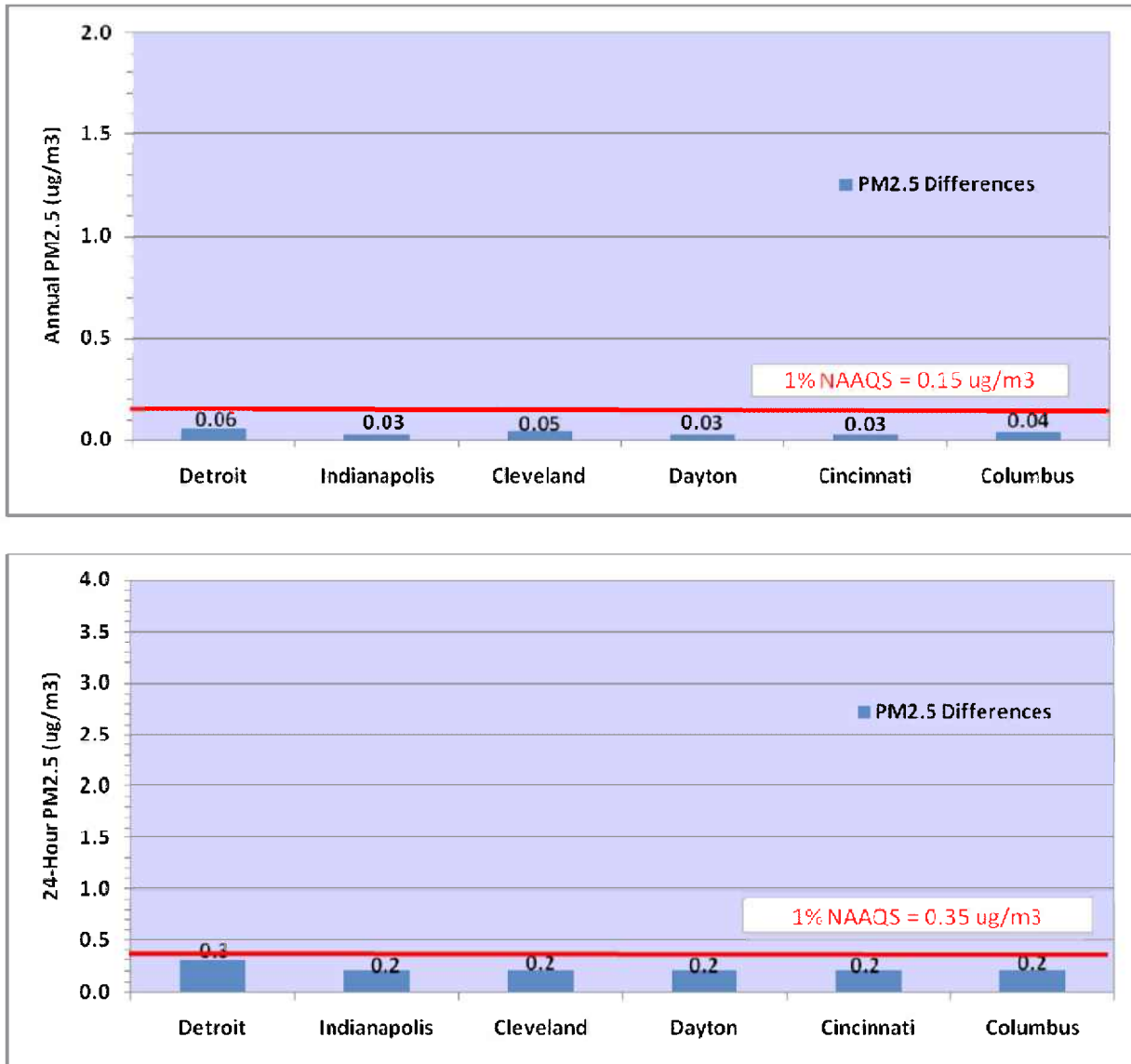


Figure 5. Effect of Plaintiff's estimated PM_{2.5} differences on annual and 24-hour PM_{2.5} design values in surrounding nonattainment areas compared to 1% of PM_{2.5} NAAQS

Opinion 2d. Plaintiff's Estimates Of PM_{2.5} Differences in Ambient Air From Alleged Excess Emissions Are Smaller Than USEPA's Recently-Adopted Annual PM_{2.5} SILs Everywhere In The Region Modeled And Are Smaller Than The Most Appropriate 24-Hour PM_{2.5} SILs On Nearly Every Day Modeled. In Nearly Every Grid Cell

32. On September 29, 2010, USEPA took final action to establish a number of elements of the Clean Air Act's Prevention of Significant Deterioration (PSD) program for PM_{2.5}, including adoption of Significant Impact Levels (SILs) for PM_{2.5}. In its final rule (USEPA 2010c, p. 64891), USEPA stated that: "The primary purpose of the SILs is to identify a level of ambient impact that is sufficiently low relative to the NAAQS or [PSD] increments that such impact can be considered trivial or *de minimis*." Under the PSD program, a screening-level assessment is conducted as an initial step in evaluating a project's air quality impact. If the screening-level air quality impact of the project's emissions is less than the SILs, that project's air quality impact is deemed to be *de minimis*. Equaling or exceeding a SIL in the screening-level air quality impact assessment is not in itself a demonstration that a project would contribute significantly to a violation of the NAAQS or an exceedance of PSD increments. Rather, it would trigger a more comprehensive, cumulative air quality impact assessment in which the project's contribution significance would be determined.

33. In its recent action, USEPA adopted SILs for each of the three PSD area classes. Area classifications differ in the amount of growth permitted before significant air quality deterioration is judged to have occurred. Areas designated as Class I, for which the PSD program provides special protection, include large national parks, wilderness areas, national memorial parks, wildlife refuges, and international parks. All other areas initially were designated Class II. Although it is possible under the Clean Air Act to redesignate a Class II area to Class III, there are currently no Class III areas. For each PSD class, USEPA adopted annual and 24-hour average SILs, corresponding to the averaging times of the annual and 24-hour PM_{2.5} NAAQS. The most closely applicable of the SILs to the Monroe Power Plant are those for Class II and Class III areas, for both of which USEPA has adopted the same values: 0.3 µg/m³ for annual PM_{2.5} and 1.2 µg/m³ for 24-hour PM_{2.5}.

34. Using the air quality modeling relied on by Mr. Chinkin (*i.e.*, Baker and Timin 2008), PM_{2.5} differences in ambient air from alleged excess emissions were estimated for each grid cell in the region modeled (*see also* Morris 2010 for a further discussion of the methodology used). Differences were then compared to the PM_{2.5} SILs recently adopted by USEPA.

35. Mr. Chinkin estimated in his declaration that the grid-wide maximum annual PM_{2.5} difference in ambient air resulting from alleged excess emissions would be 0.10 µg/m³, which modeling calculates would occur in the immediate vicinity of the plant. This grid-wide maximum difference is a third of USEPA's annual PM_{2.5} SIL of 0.3 µg/m³, or put another way, a factor of three smaller than the SIL. By definition, annual PM_{2.5} differences in all other portions of the modeled region would be less than the grid-wide maximum difference, and thus would be an even smaller fraction of the SIL.

36. Daily 24-hour PM_{2.5} differences in ambient air estimated by Mr. Chinkin are smaller than the 24-hour PM_{2.5} SIL adopted by USEPA on nearly every day modeled, in nearly every grid cell. The maximum 24-hour PM_{2.5} difference in ambient air during the entire modeled year was calculated for each grid cell and compared to the 24-hour PM_{2.5} SIL. This maximum difference is less than the 24-hour PM_{2.5} SIL for 99.8% of the grid cells in the modeling region, that is, all but 13 of 7,650 grid cells modeled. While the maximum difference in any grid cell on any day during the year would exceed the SIL by 24%, the differences on average across grid cells would be about five times smaller than the SIL.

37. Estimated 24-hour PM_{2.5} differences in ambient air would equal or exceed the 24-hour PM_{2.5} SIL on just five days during the modeled year. On three of those days, this is calculated to occur just in the single grid cell where the Monroe Power Plant is located; on two other days, it would occur just in two other grid cells, also near the plant; and only on one day would it occur in more than two grid cells. No grid cell, except for the one in which the Monroe Power Plant is located, would experience a PM_{2.5} difference equal to or above the SIL on more than one day during the modeled year.

38. In any event, a PM_{2.5} difference in ambient air above the SIL cannot be judged to contribute significantly to a violation of the NAAQS if ambient PM_{2.5} from all

sources is less than the level of the NAAQS. Importantly, all-source 24-hour $PM_{2.5}$ did not exceed the NAAQS on any of the five days on which estimated $PM_{2.5}$ differences equaled or exceeded the SIL. On average during those five days, all-source $PM_{2.5}$ is more than a factor of two smaller than the NAAQS. On those days, $PM_{2.5}$ differences are about twenty-five times smaller than the NAAQS and more than six times smaller than EPA's newly adopted 24-hour $PM_{2.5}$ PSD increment.

Opinion 3 – Health Impact Estimates Of Plaintiff Are Not Reliable

Opinion 3a. *Premature Mortality Estimates Of Plaintiff's Expert Dr. Schwartz Are Calculated Using An Overly Simplified Approximation That Relies On Outdated Methods And Unsupported Assumptions; Further, Because They Are Not Based On State-Of-The-Science Modeling Of The Material Facts Of This Case, His Estimates Are Not Reliable*

39. In what he refers to as a “quantitative risk assessment,” Dr. Schwartz calculated the number of cases of premature mortality that he estimates would be associated with the alleged excess emissions from Monroe Unit 2. He provides little supporting detail on his calculations, instead offering just a brief overview of his methods and summary of results in two pages near the end of his 58-page declaration.

40. Dr. Schwartz states that his premature mortality estimate is based on a study (Levy et al. 2009) that he and others did to estimate health-related damages from 407 coal-fired power plants in the United States using emission data for the year 1999. He states that the Levy et al. study concluded that median estimates of annual premature mortality costs across all the power plants analyzed were \$19,000 and \$4,800 per ton of SO_2 and NO_x emitted per year, respectively.

41. Based on these estimated costs per ton and Plaintiff's alleged excess emissions from Monroe Unit 2, Dr. Schwartz calculated that excess emissions would cause ninety premature deaths per year. Bypassing much of the complex but essential atmospheric physics and chemistry in current state-of-the-science air quality models, Dr. Schwartz employed the following overly simplified, “back-of-the-envelope” approximation.

$$\begin{aligned} \text{Premature Deaths} &= \text{Mortality Cost Per Ton} \times \text{Tons Excess Emissions} \\ &/ \$6,000,000 \text{ Per Life (As Assumed By Levy et al.)} \end{aligned}$$

42. In calculating his estimate of premature deaths, Dr. Schwartz did not perform his own modeling of the atmospheric transport and chemical transformation of alleged excess emissions from Monroe Unit 2, nor did he use the PM_{2.5} differences estimated by Mr. Chinkin. Instead, by basing his calculations on Levy et al., Dr. Schwartz implicitly relied on an incomplete representation of atmospheric transport and chemistry that is technically unreliable and that was replaced some time ago by more technically sound, state-of-the-science modeling approaches (*see* Opinion 3b).

43. Dr. Schwartz's estimate of premature mortality is unreliable not only for the above reasons, but also because it relies on simple and approximate linear scaling of emissions to predict PM_{2.5} air quality impacts, a method whose accuracy and reliability he has not evaluated. Such scaling also assumes without verification or testing that conditions assumed to be valid in calculating premature mortality costs per ton for the year 1999, including use of a source-receptor (S-R) matrix developed in the mid-1990s and designed for the base year 1990 (*see* Opinion 3b), also are valid for Monroe Unit 2 in 2010. Such assumptions, while convenient and expedient, have not been validated by Dr. Schwartz, and the underlying calculations fail to account for essential aspects of atmospheric transport and chemistry (*see also* Morris 2010).

Opinion 3b. Premature Mortality Estimates Of Dr. Schwartz Rely On Incomplete And Outdated Representations Of Atmospheric Transport And Chemistry That Have Serious And Acknowledged Technical Shortcomings, And Thus His Estimates Are Not Reliable

44. To make his premature mortality estimate, Dr. Schwartz relies on the prior use by Levy et al. (2009) of an outdated and inaccurate S-R matrix to represent the transport and dispersion of emissions. The S-R matrix was constructed in the mid-1990s using the Climatological Regional Dispersion Model (CRDM). CRDM is a Gaussian plume model that uses an approach similar to that of USEPA's Industrial Source Complex Long Term (ISCLT) model, which has now been superseded by subsequent models and is no longer supported by USEPA. CRDM combines climatological summaries (an-

nual average mixing heights and joint frequency distributions of wind speed, direction, and atmospheric stability) from different meteorological sites with sector-averaged air concentration calculations to make frequency-weighted estimates of annual average PM concentrations at downwind locations.

45. In constructing the S-R matrix, CRDM, as a Gaussian model, assumes that transport in any given wind direction occurs instantaneously in a straight line along that wind direction. USEPA has concluded that Gaussian models are not valid for distances greater than 50 km (*e.g.*, see 40 C.F.R. Pt. 51, App. W 6.2.3). Yet, Dr. Schwartz's S-R matrix relies on modeling assumed to be valid at distances of hundreds of kilometers, well beyond the 50 km limit of Gaussian model validity. Thus, Dr. Schwartz's reliance on the CRDM-derived S-R matrix is contrary to widely accepted limits on Gaussian model validity.

46. Importantly, CRDM does not consider the full complexity of relevant atmospheric chemical processes, and instead relies on a simplified and incomplete idealization of those processes. Moreover, CRDM makes a number of additional simplifying, idealized assumptions regarding source configuration and other important variables. Thus, the model on which Dr. Schwartz relies is unreliable.

47. Limitations in the validity of CRDM are widely recognized. For example, CRDM was used in several USEPA regulatory impact assessments in the mid-to-late 1990s (*e.g.*, USEPA 1996, 1997, 1999). However, recognizing CRDM technical shortcomings such as those listed above, all three of these USEPA documents contain the same or a similar caution.

The CRDM modeling does not reflect application of state-of-the-art techniques, and serves as a placeholder until more advanced modeling is available. Many of the physical and chemical formulations in the CRDM are crude representations of actual mixing and reaction phenomena required to address aerosol formation, transport and removal phenomena. (USEPA 1996)

48. These technical shortcomings are serious, and are an important reason why USEPA replaced CRDM with more sophisticated, state-of-the-science air quality models. Several generations of successively improved air quality models have been de-

veloped and used since CRDM. Current state-of-the-science models have long since replaced the S-R matrix approach used by Dr. Levy et al. and relied upon by Dr. Schwartz.

49. Dr. Schwartz has not provided documentation or calculations to support his use of CRDM calculations in the S-R matrix on which he relies. Because CRDM calculations have not been made available for review, it has not been possible to examine the Monroe Power Plant data that were used by CRDM, or any other aspect of its S-R matrix calculations relevant to this case.

50. Also, Dr. Schwartz has not subjected the CRDM modeling on which the S-R matrix is based to model performance evaluation. This is in contrast to accepted modeling practice and the performance evaluation by Morris (2010) of the modeling relied on by Mr. Chinkin. Dr. Schwartz, thus, cannot know the reliability and accuracy of CRDM modeling or the S-R matrix on which he relies. Thus, for reasons such as those stated above, Dr. Schwartz's estimate of premature mortality is seriously flawed, unverified, and unreliable.

Opinion 4 – Additional Material Uncertainties Are Present In Plaintiff's Estimates

Opinion 4a. Uncertainty Is Caused By Plaintiff's Use Of Atypically Adverse 2005 Meteorological Data To Estimate PM_{2.5} Differences

51. To estimate alleged excess emission PM_{2.5} differences, Mr. Chinkin relied on air quality modeling done previously by USEPA. Specific to USEPA's purpose at the time it was done, that modeling used as a primary input meteorological data for the year 2005. However, meteorological conditions in 2005, which were used in the modeling relied on by Mr. Chinkin, are more adverse than in any other year during 1999-2008, the years examined below and in Figures 6 through 8 of this declaration.

52. Figure 6 plots the percentage of monitors that measured annual PM_{2.5} concentrations above the 15 µg/m³ concentration level of the annual PM_{2.5} NAAQS during 1999-2008 in Michigan and surrounding states Indiana, Illinois, Ohio, Kentucky, Pennsylvania, Wisconsin, West Virginia, Iowa, and Missouri. The figure shows that more monitors measured annual PM_{2.5} above the NAAQS in 2005 than in any other year during the ten-year period 1999-2008.

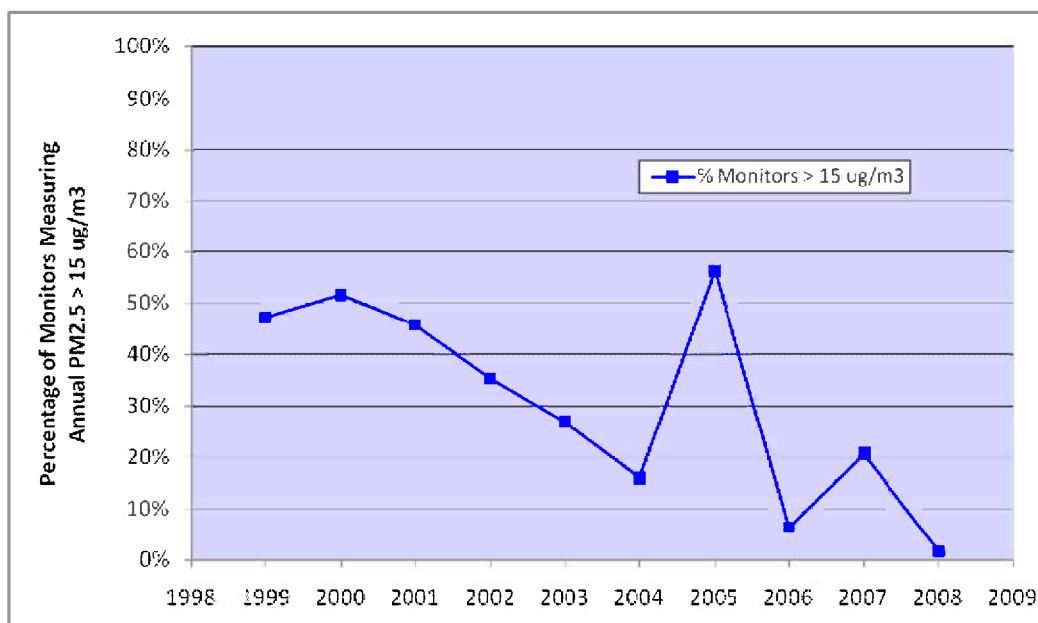


Figure 6. Percentage of monitors measuring annual $PM_{2.5} > 15 \mu g/m^3$ during 1999 – 2008 in MI, IN, IL, KY, OH, PA, WI, WV, IA, and MO

53. This can also be seen graphically in Figure 7, which maps the locations of monitors measuring annual $PM_{2.5}$ above the NAAQS each year during 2000-2007 (note that the range of years in Figure 7 is different than in Figure 6 because the model used to generate Figure 7 relies on a monitoring database that is currently limited to 2000-2007). Both figures, however, clearly show that 2005 was an atypically adverse year.

54. Similarly, Figure 8 shows annual $PM_{2.5}$ measured from 2000 through 2008 at example monitors in Detroit, Cleveland, Cincinnati, and Gary, as obtained from USEPA's Air Trends website at www.epa.gov/airtrends/index.html (note that 2000-2008 are the years for which trend data are available from that website). These example monitors all exhibit downward trends in annual $PM_{2.5}$ (presumably due to emission reductions), with the exception of 2005, for which an atypical $PM_{2.5}$ "bump" is seen.

55. A similar assessment of 2005 has been made by others. For example, USEPA characterized 2005 as being more conducive to sulfate formation in the Industrial Midwest and Northeast than other years during 2002-2006 (USEPA 2008a), and other

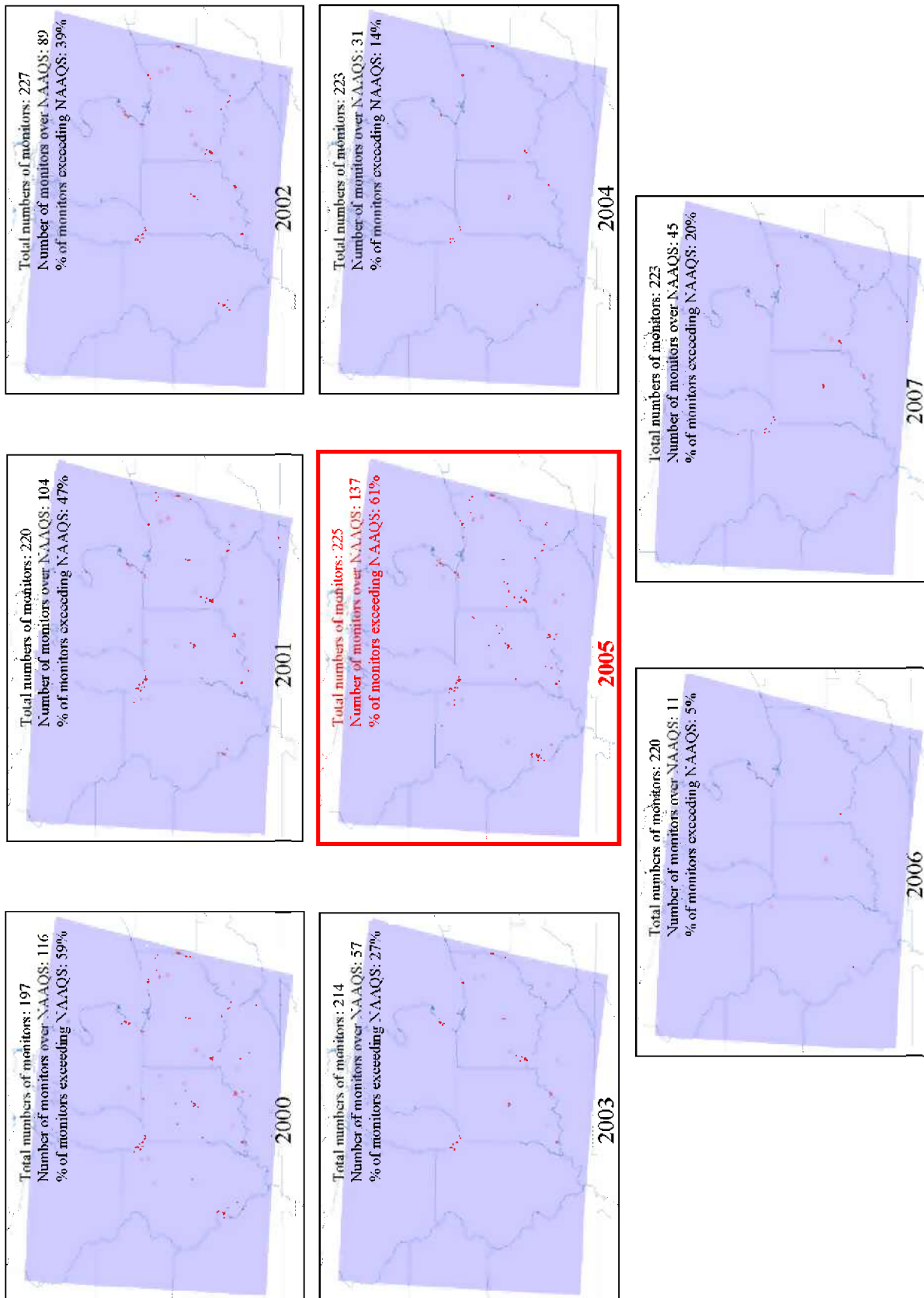


Figure 7. Comparison of number of monitors in 2000-2007 measuring annual $PM_{2.5}$ over the NAAQS ($15 \mu g/m^3$)

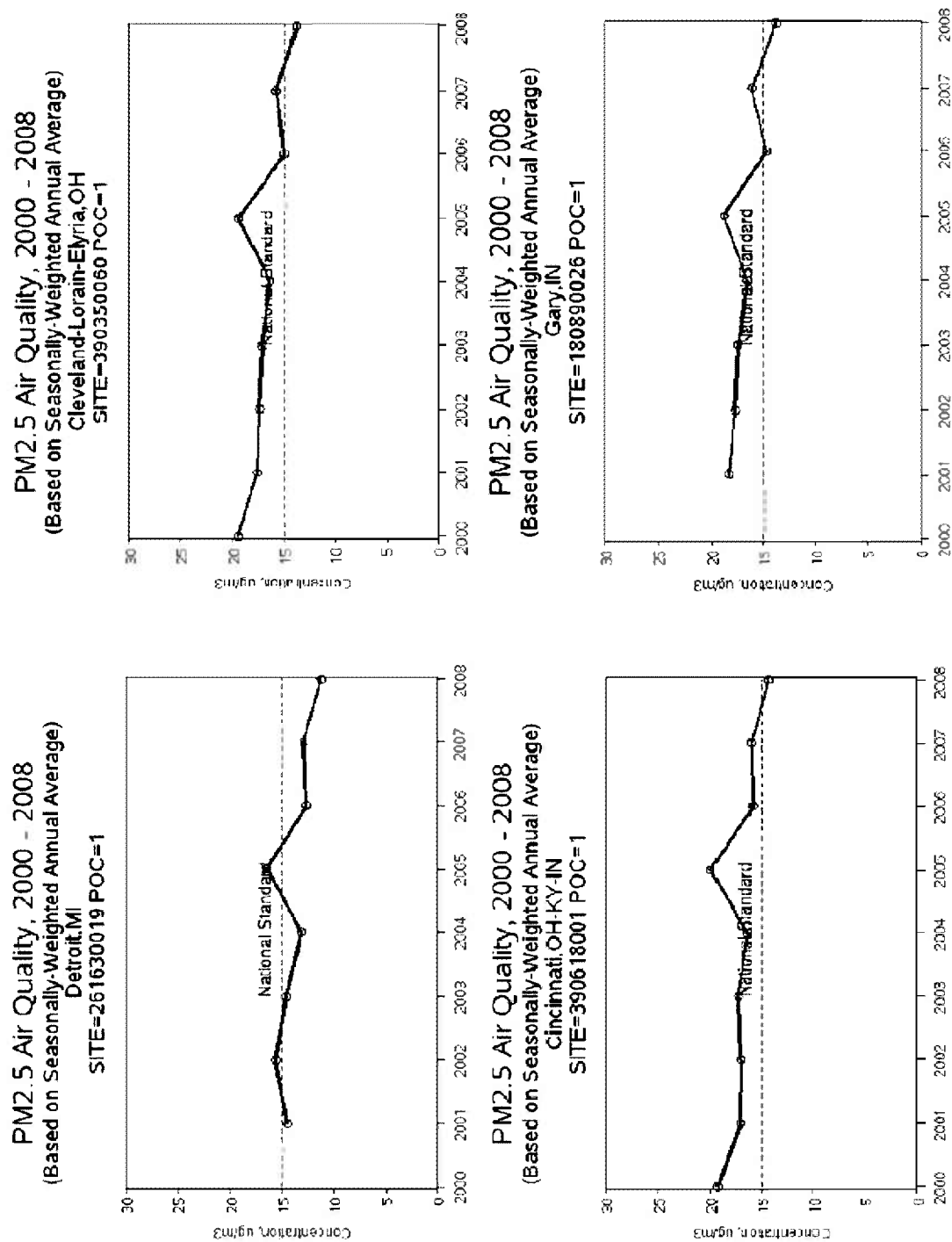


Figure 8. Annual PM_{2.5} trends from 2000 – 2008 at example monitors in Detroit, Cleveland, Cincinnati, and Gary

agencies that include the Kentucky Division for Air Quality (KDAQ 2006) and the Midwest and Northeast than other years during 2002-2006 (USEPA 2008a), and other agencies that include the Kentucky Division for Air Quality (KDAQ 2006) and the Illinois Environmental Protection Agency (IEPA 2006) reported that PM_{2.5} levels were higher in 2005 than in other years.

56. Note that the clear downward trend in annual PM_{2.5} levels seen in each of the figures suggests that appreciable emission reductions have occurred over the last decade. It seems likely that the emission primary and precursor “mix” has also changed along with reductions in the amounts emitted. To the extent that this is so, additional uncertainty is introduced into Mr. Chinkin’s PM_{2.5} difference estimates, since those estimates are based on air quality modeling done using the emission amounts and primary and precursor mix that existed in 2005, and likely no longer exists now in 2010.

57. Because 2005 meteorological conditions were atypically adverse, that is, more conducive to formation of higher PM_{2.5} concentrations compared to the other years examined below, Mr. Chinkin’s reliance on 2005 air quality modeling causes his estimates of PM_{2.5} concentration differences due to the alleged excess emission of PM_{2.5} to be systematically overstated. Moreover, with respect to any alleged excess emission PM_{2.5} differences since re-start of Monroe Unit 2 in June 2010, Mr. Chinkin has not demonstrated that meteorological conditions in 2005 are representative of conditions that have occurred since Monroe Unit 2 re-start.

Opinion 4b. Uncertainty Is Caused By Plaintiff’s Failure To Account For The Physical Effects On Stack Plume Dispersion Of Emission Control Equipment, Thus Causing PM_{2.5} Differences From Excess Emissions To Be Systematically Overstated

58. In estimating PM_{2.5} differences from alleged excess emissions, Mr. Chinkin assumed that emission control equipment was installed on Monroe Unit 2 sufficient to achieve 95% reduction in SO₂ and 90% reduction in NO_x. Mr. Chinkin’s estimated differences, however, do not account for the physical effects that emission control equipment intended to achieve such reductions would have on stack plume rise.

59. For example, a wet scrubber (*e.g.*, *see* USEPA 2004) typically causes changes in the characteristics of gases exiting from the stack (*e.g.*, cooler temperature, lower exit velocity). These changes would reduce plume buoyancy and upward momentum, and thus lower the effective height of the stack plume, causing higher ground-level concentrations from the stack on a per-pound basis after wet scrubber installation than before.

60. The increased per-pound ground-level impact resulting from a cooler, lower plume would be greatest immediately adjacent to the plant, but would persist further downwind. If a wet scrubber were to be used to eliminate alleged excess emissions, the effectiveness of that wet scrubber in reducing downwind SO₂ concentrations and thus sulfate PM_{2.5} would be reduced, an effect that Mr. Chinkin would have to consider. Chinkin's failure to do so would cause him to overstate the benefits of wet scrubber installation, and thus, to overstate the impact of alleged excess emissions.

Opinion 4c. Uncertainty Is Caused By Plaintiff's Analysis Approach, Resulting From Such Factors As Inherent Limits On The Accuracy Of Air Quality Models And Use Of Linear Scaling Of PSAT Modeling Results

61. Additional uncertainty is introduced into Mr. Chinkin's estimates of PM_{2.5} differences attributed to alleged excess emissions by the analysis approach that he used. Defendants' expert Mr. Morris identifies and evaluates a number of important sources of that uncertainty. I have examined Mr. Morris' declaration (Morris 2010), and I concur in his evaluation of those uncertainties.

62. For example, uncertainty is introduced into Mr. Chinkin's estimates of PM_{2.5} differences because of inherent limits on the accuracy of air quality models. Mr. Morris' evaluation of air quality model performance demonstrates that uncertainties in the modeling on which Mr. Chinkin relies are significantly larger than the PM_{2.5} differences that he estimates would result from alleged excess emissions.

63. Mr. Morris discusses in his declaration the results of his performance evaluation of the modeling relied on by Mr. Chinkin and identifies a number of specific reasons contributing to the uncertainties that Mr. Morris found to be present. I agree with

Mr. Morris that the presence of such modeling uncertainties results in significant uncertainty in Plaintiff's experts' estimates of impacts from alleged excess emissions.

64. Also, the USEPA 2005 CAMx air quality modeling relied on by Mr. Chinkin employed PSAT, which was developed by ENVIRON. As discussed by Mr. Morris, PSAT is designed to estimate a source's contribution to PM_{2.5} concentrations in the year modeled, not to estimate the effect of reductions in emissions from that source.

65. I agree with Mr. Morris that Mr. Chinkin's linear scaling of PSAT results to represent the effects of removing excess emissions from Monroe Unit 2 is inappropriate. Linear scaling fails to account for important physical, chemical, and atmospheric processes, thus causing Mr. Chinkin to overstate PM_{2.5} differences. Mr. Chinkin's approach incorrectly assumes that sulfate formation is linear everywhere downwind, and it fails to account for nitrate replacement that occurs when sulfate is reduced. These and other reasons are also discussed by Morris (2010).

Opinion 5 – Excess Emission Comparisons Are Misleading

Opinion 5a. Plaintiff's Emission-Based Comparisons Of Alleged Excess Emissions To Other Sources Of SO₂ And NO_x Emissions Into Ambient Air Are Misleading Because They Do Not Account For Comparative Effects On Air Quality

66. Mr. Chinkin attempts to equate the amount of alleged excess emissions from Monroe Unit 2 to the SO₂ emissions from what he represents to be all of the heavy-duty trucks registered in the states of Michigan, Illinois, Ohio, and Indiana and to the NO_x emissions from about 1 million passenger cars. Such emission-based comparisons, however, are misleading.

67. The most relevant comparison of different sources of emissions is not on the basis of their emission amounts, but rather, their respective effects on ambient air concentrations at the specific geographical locations of interest. Such comparative ambient concentration effects must be estimated by air quality modeling, not simply by comparing emission amounts, without regard to such material factors as source proximity, air dispersion, orientation with respect to prevailing winds, and patterns of population exposure.

Opinion 5b. Plaintiff's Emission-Based Comparisons Of Alleged Excess Emissions To Other Sources Are Misleading Because, Among Other Things, They Do Not Account For Important Differences Among Sources

68. Mr. Chinkin's emission-based comparisons do not account for important differences among sources that contribute to PM_{2.5} in ambient air. For example, Mr. Chinkin does not account for differences in the significance of SO₂ relative to other source emissions. In contrast to power plants, heavy-duty trucks are much larger emitters of other compounds than SO₂. According to USEPA's 2002 National Emission Inventory (NEI 2002), on-road vehicles (which includes heavy-duty trucks) collectively emitted only 1.8% of SO₂ in the U.S. in 2002.

69. By using heavy-duty trucks as a benchmark for comparison, because a truck emits comparatively smaller amounts of SO₂ per mile than of other compounds, Mr. Chinkin has magnified the apparent relative size of his excess emission comparison. Mr. Chinkin's attempt to compare alleged excess emissions from Monroe Unit 2 to emissions from the Holcim and United States Steel Great Lakes Works plants is similarly misleading.

*


*


*

70. While I have offered here opinions regarding several specific matters relating to this case, I reserve the right to consider additional information, should it become available, and to perform additional analyses if I am asked to do so.

71. I declare under penalty of perjury that the foregoing is true and correct.

Signed by


Stanley R. Hayes


Date

IV. REFERENCES

72. In preparing this declaration, I relied on sources of information that include the following:

- (1) Baker, K., and B. Timin. 2008. "PM2.5 Source Apportionment Application in Support of 24-hr PM2.5 NAAQS Designation Process." U.S. Environmental Protection Agency, Research Triangle Park, North Carolina. August 25.
- (2) Chinkin, L. 2010. Declaration of Lyle Chinkin, Exhibit 1 to the Memorandum in Support of Plaintiff's Motion for Preliminary Injunction, *United States v. DTE Energy Co.*, No. 2:10-cv-13101-BAF-RSW (E.D. Mich. Aug. 6, 2010).
- (3) DOJ. 2010. Plaintiff's Motion for Preliminary Injunction, *United States v. DTE Energy Co.*, No. 2:10-cv-13101-BAF-RSW (E.D. Mich. Aug. 6, 2010).
- (4) IEPA. 2006. "Illinois Annual Air Quality Report 2005." Illinois Environmental Protection Agency, Springfield, Illinois. December.
- (5) KDAQ. 2006. "Kentucky Ambient Air Quality Annual Report 2005." Kentucky Division for Air Quality, Frankfort, Kentucky.
- (6) LADCO. 2008. "Regional Air Quality Analyses for Ozone, PM2.5, and Regional Haze. Final Technical Support Document." States of Illinois, Indiana, Michigan, Ohio, and Wisconsin. April 25.
- (7) Levy, J.I., L.K. Baxter, and J. Schwartz. 2009. Uncertainty and variability in health-related damages from coal-fired power plants in the United States. *Risk Anal.*, 10.1111/j. 1539-6924.2009.01227.x. Published online. April 9.
- (8) Morris, R. 2010. Declaration of Ralph Morris. *United States v. DTE Energy Co.*, No. 2:10-cv-13101-BAF-RSW (E.D. Mich. Nov. 2010).
- (9) NEI. 2002. "2002 National Emissions Inventory Data & Documentation." U.S. Environmental Protection Agency. On web at www.epa.gov/ttnchie1/net/2002inventory.html.
- (10) Schwartz, J. 2010. Declaration of Dr. Joel Schwartz, Exhibit 12 to the Memorandum in Support of Plaintiff's Motion for Preliminary Injunction, *United States v. DTE Energy Co.*, No. 2:10-cv-13101-BAF-RSW (E.D. Mich. Aug. 6, 2010, corrected Aug. 24, 2010).

- (11) Seitz, J.S. 1997. "Interim Implementation of New Source Review Requirements for PM_{2.5}." Memorandum from John S. Seitz, Director, Office of Air Quality Planning & Standards, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina.
- (12) USEPA. 1996. "Regulatory Impact Analysis for Proposed Particulate Matter National Ambient Air Quality Standard. Draft." U.S. Environmental Protection Agency, Research Triangle Park, North Carolina. December.
- (13) USEPA. 1997. "Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule." U.S. Environmental Protection Agency, Research Triangle Park, North Carolina. July 17.
- (14) USEPA. 1999. "Regulatory Impact Analyses for the Final Section 126 Petition Rule." U.S. Environmental Protection Agency, Washington, DC. December.
- (15) USEPA. 2004. "Identification of (and Response to) Potential Effects of SCR and Wet Scrubbers on Submicron Particulate Emissions and Plume Characteristics." EPA-600/R-04/107. U.S. Environmental Protection Agency, Research Triangle Park, North Carolina. August.
- (16) USEPA. 2007. "Part II, Prevention of Significant Deterioration (PSD) for Particulate Matter Less than 2.5 Micrometers (PM_{2.5}) – Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentration (SMC); Proposed Rule." Federal Register, Vol. 72, No. 183, p. 54112. September 21.
- (17) USEPA. 2008a. "Latest Findings on National Air Quality, Status and Trends Through 2006." EPA-454/R-07-007. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. January.
- (18) USEPA. 2008b. "Modeled Attainment Test Software, User's Manual." Abt Associates Inc., Bethesda, MD for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. June.
- (19) USEPA. 2010a. "Federal Implementation Plans to Reduce Interstate Transport of Fine Particulate Matter and Ozone, Proposed Rule." 75 Fed. Reg. 45,273(Aug. 2, 2010).
- (20) USEPA. 2010b. "Air Quality Modeling, Technical Support Document (TSD) for the Transport Rule, Docket ID No. EPA-HQ-OAR-2009-0491." U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. June.

- (21) USEPA. 2010c. "Prevention of Significant Deterioration (PSD) for Particulate Matter Less Than 2.5 Micrometers (PM_{2.5}) – Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentration (SMC), Final Rule." 75 Fed. Reg. 64,864 (Oct. 20, 2010)..
- (22) USEPA. 2010d. "Prevention of Significant Deterioration for Fine Particle Pollution – Final Rule to Establish Increments, Significant Impact Levels and a Significant Monitoring Concentration, Fact Sheet." U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. September 29.

Attachment A

**Resume of
Stanley R. Hayes**

Stanley R. Hayes**Education**

Graduate Studies, Engineering and Applied Mathematics, University of Southern California and University of California, Irvine

1968 M.S., Aeronautics & Astronautics, Stanford University

1967 B.S., Mechanical Engineering, Stanford University

Experience

Mr. Hayes is a Principal at ENVIRON Corporation. He has more than twenty-five years of experience in environmental engineering and science, with particular emphasis on air impact analysis, air-related environmental impact analysis, air quality modeling, Clean Air Act strategic assessment and permitting, exposure and health risk analysis, air toxics, ozone, air pollution abatement, and regulatory compliance. His experience includes the following:

As a Principal at ENVIRON, Mr. Hayes is responsible for

- New business development, particularly in air policy analysis, corporate and facility air strategic planning, air quality impact assessment, environmental exposure analysis, and air toxics and criteria pollutant health risk assessment.
- Preparation of proposals for major technical projects, and subsequent project design, staffing, and management.
- Expert testimony before federal, state, and local agencies, including expert witness and litigation support work, across a broad range of areas, including air dispersion modeling, emission inventory development, and population exposure analysis.
- Management of profit-and-loss for practice area, development and maintenance of client relationships, staff hiring, project staffing and management, and growth.
- Publication of technical reports and scientific papers, conference presentations, and expert testimony before national, state, and local regulatory and legal bodies.

Projects directed by Mr. Hayes at ENVIRON include

- Air dispersion, exposure, and health risk assessments for a wide range of industrial and other facilities, including mining operations, refineries, petrochemical complexes, airports, power plants, and manufacturing plants. Work involved emission characterization, air dispersion modeling, population exposure calculation, and multipathway cancer and noncancer health risk assessment.
- Expert witness and litigation support in toxic tort cases in Arkansas, Alabama, California, Florida, Indiana, Kentucky, Louisiana, Oklahoma, Texas, and Wyoming, involving a broad range of industrial facilities, including petroleum refineries, petrochemical complexes, and manufacturing facilities. Work involved industrial process analysis,

Stanley R. Hayes

development and verification of emission inventories, air dispersion modeling, and population exposure assessment.

- Corporate and facility strategic analyses (e.g., Title V/Clean Air Act) for more than twenty facilities in fifteen states. Work entailed emissions inventory development, calculation of potential to emit, determination of applicable federal requirements, identification and evaluation of alternative corporate response strategies, design of permit conditions allowing maximum operation flexibility, and permit preparation.
- Air-related analysis of airport operations (particularly for environmental impact assessments), including emission estimation, aircraft air toxics speciation, dispersion modeling, and health risk assessment.
- Particulate matter and ozone analyses, including health risk assessment, population exposure analysis, control strategy design and development, air monitoring data analysis, analysis of alternative U.S. national ambient air quality standards, and regulatory policy analysis.
- A major multi-year research program for the Electric Power Research Institute to develop and apply innovative exposure assessment models and data bases. The modeling methodology examined exposure to fine particulate matter and acidic aerosols and gases.
- Development and application of Monte Carlo air toxics exposure assessment models for a number of clients, including several national industrial trade organizations. Models obtain more realistic results than standard regulatory methods by considering activity patterns, indoor-outdoor differences, residency duration, and other sources of variability.
- Analyses of major air quality-related legislation, regulations, and technical support documents for many leading U.S. trade associations, including the American Automobile Manufacturing Association, the American Petroleum Institute, the Chemical Manufacturers Association, the Western States Petroleum Association, the National Petroleum Refiners Association, the American Industrial Health Council, the Specialty Steel Institute of the United States, and the Asbestos Institute, and for a variety of law firms and individual manufacturers.

While at Systems Applications in San Rafael, California, Mr. Hayes held the following positions: Vice President and Director, Environmental Sciences; Manager, Risk Assessment Services; Senior Project Manager; and Senior Scientist. He was responsible for staff hiring in Environmental Sciences, project management, and growth of corporate environmental planning and engineering services; these services included risk assessment, exposure analysis, management of air toxics, urban planning, development of alternative fuels, urban airshed modeling applications, regulatory compliance analysis, permitting, emissions inventory development, and policy analysis.

Major areas of expertise are as follows:

- Environmental Engineering and Science: Air quality modeling; regulatory compliance (including the Clean Air Act and Title V permitting); risk assessment and management; exposure analysis; indoor air quality; air pollution health effects; regulatory policy analysis; hazardous materials/air toxics; alternative motor vehicle fuels; litigation

Stanley R. Hayes

support/expert testimony; atmospheric sciences; air pollution formation/dynamics; air pollution abatement strategies.

- Economics: Regulatory impact analysis; economics of regulated firms; effects of federal deregulation; cost-benefit analysis; financial behavior of regulated firms; impact of regulatory policies; federal telecommunications policy.
- Land Use Planning: Development of general plans; planning commission and city council presentations; zoning/land use planning regulations; land use development procedures.

While at McDonnell-Douglas Astronautics Company, Huntington Beach, California, Mr. Hayes was a Senior Engineer/Scientist, Aerospace Research. Major areas of expertise include aerospace mechanical engineering; optimal flight/trajectory design; earth/planetary orbital mechanics; aerospace flight and vehicle dynamics; federal space policy analysis; large-scale computer program design.

Professional Affiliations

Fellow, Air & Waste Management Association; conferred June 2006.

Member, 1995-2006, 2009-, Advisory Council, Bay Area Air Quality Management District (Greater San Francisco Area); Chair, 1999-2000; Vice Chair, 1998-1999; Secretary, 1997-1998; Chair, Air Quality Planning Committee, 2006; Chair, Technical Committee, 1996-1998.

General Conference Chair, Air & Waste Management Association Specialty Conference on "Harmonizing Greenhouse Gas Assessment and Reporting Processes," Baltimore, Maryland, September 1-2, 2009.

General Conference Chair, Air & Waste Management Association Specialty Conference on "Planning for the Future: Climate Change, Greenhouse Gas Inventories & Clean Energy Linkages," San Francisco, California, March 7-9, 2006.

Co-Chair, Air & Waste Management Association Specialty Conference on "Environmental Security After 9-11," San Francisco, California, August 22-23, 2002.

Chair, Air & Waste Management Association's Inter-Committee Task Force on Environmental Security (ITF-9), 2002-2005; Chair, Effects Division, 2001-2003, Vice Chair, 2000-2001; Chair, Health Effects and Exposure Technical Committee (EE-1), 1994-1997; Vice Chair, Climate Change Management Strategies (ES-5), 2009-; member, Meteorology Committee (AB-3) and Risk Assessment/Management Committee (EE-5); member, Editorial Advisory Committee, 2002-2005.

Chair, Air & Waste Management Association Annual Meeting technical sessions: "Greenhouse Gas Management and Other Environmental Programs," 2010; "Greening Industrial Buildings," 2009; "Interactions Between Climate Change and Traditional Air Programs," 2007; "Homeland and Environmental Security," 2004; "Plenary Panel: Homeland & Environmental Security," 2003; "Approaches to Exposure and Risk Assessment," 2001 and 2000; "Approaches to Risk Assessment and Management," 1999; "Ambient Air Quality Standards: Ozone," 1998 (Co-Chair); "Health & Exposure: Implications for Ozone and PM Standard Setting," 1997; "Ozone

Stanley R. Hayes

Ecological and Health Effects Pertinent to Standard Development," 1996; "Recent Advances in Exposure Assessment," 1995 and 1993; "Ambient Standards," 1984.

Member, Steering Committee for Climate Protection Summit, San Francisco, California, November 10, 2006.

Member, Comparative Risk Project, Human Health Committee, State of California, 1993-1994.

Chair, Society for Risk Analysis annual meeting technical session, MPM-L "Dose Response," 1989.

Co-chair, Waste Management (AB 939) Advisory Committee, County of Marin; also Chair, Hazardous Materials Subcommittee; 1988-1994.

Member, Hazardous Materials Task Force, County of Marin, 1985-1988.

Chair, Planning Commission, San Anselmo, California 1988, 1983, and 1982; Vice-Chair, 1987 and 1981; Member, 1979-1995.

Publications And Presentations

Mr. Hayes is principal author of several hundred technical reports and a number of scientific papers and conference presentations. He has provided expert testimony in court and before national, state, and local regulatory bodies, including the U.S. Science Advisory Board's Clean Air Scientific Advisory Committee, the California Air Resources Board, and the South Coast Air Quality Management District (Los Angeles area). Selected references are listed below:

- S. Hayes. 2009. General conference co-chair welcome address. Presented at Specialty Conference on Harmonizing Greenhouse Gas Assessment and Reporting Processes, Air & Waste Management Association, Baltimore, Maryland. September 1-2.
- S. Hayes. 2009. Review and evaluation of the Risk-Screening Environmental Indicators (RSEI) Model. Presented at 2009 EPA/ECOS TRI National Training Conference, Bethesda, Maryland, March 30 – April 2.
- S. Hayes. 2007. Interactions between climate change and traditional air programs: key issues and questions. Presentation and panel moderator, 100th Annual Conference & Exhibition, Air & Waste Management Association, Pittsburgh, Pennsylvania, June.
- S. Hayes. 2007. "What AB 32 Means for California (A Perspective from California and the EU)." Keynote Address. Optimizing Your Strategic Response to AB 32: California's Carbon Management Requirements, San Francisco (January 24) and Los Angeles (January 25).
- S. Hayes. 2006. Climate change: managing the opportunities and risks. Invited luncheon speaker, 16th Annual AEHS Meeting & West Coast Conference on Soils, Sediments and Water, San Diego, California, March.
- M. Scott and S. Hayes. 2006. Corporate strategy: opportunities for emissions reduction credits. Presented at Specialty Conference on Planning for the Future: Climate Change,

Stanley R. Hayes

- Greenhouse Gas Inventories & Clean Energy Linkages, Air & Waste Management Association, San Francisco, California. March.
- S. Hayes. 2006. General conference chair welcome address. Presented at Specialty Conference on Planning for the Future: Climate Change, Greenhouse Gas Inventories & Clean Energy Linkages, Air & Waste Management Association, San Francisco, California. March.
- S. Hayes. 2006. Monitoring vs. modeling: assessing community risk. Presented at Conference on Community Monitoring Programs, Air & Waste Management Association, Golden West Section, San Francisco, California, February.
- S. Hayes. 2005. Petroleum refinery residual risk: what the data tell us. Presented at 98th Annual Conference & Exhibition, Air & Waste Management Association, Minneapolis, Minnesota, June.
- S. Hayes. 2005. Modeling outside the box: stochastic risk analysis. Presented at conference on "Air Toxics in California: Running the Numbers – Presenting the Results," Air & Waste Management Association, Golden West Section, San Francisco, California, January.
- S. Hayes. 2003. Emerging air risk issues. Presented at 2nd Annual Environmental and Regulatory Conference & Exposition, Industrial Environmental Association and California Manufacturers & Technology Association, San Diego, California, November.
- S. Hayes. 2003. Characterizing air toxics composition of jet exhaust for airport health risk assessments. Paper #81121. Presented at 96th Annual Conference & Exhibition, Air & Waste Management Association, San Diego, California, June.
- D. Daugherty, W. Li, K. Mertz, and S. Hayes. 2003. The importance of surface roughness selection in AERMOD modeling for shoreline sources. Paper #81161. Presented at 96th Annual Conference & Exhibition, Air & Waste Management Association, San Diego, California, June.
- S. Hayes. 2003. Toxics New Source Review: practical implications of proposed changes. Presented at conference on "Technical Details of Changes Affecting Toxics NSR Regulations in California," Air & Waste Management Association, Golden West Section, San Francisco, California, May.
- S. Hayes. 2003. Importance of Kyoto Protocol to management of greenhouse gases. Presented to Women's Environmental Council, Orange County Chapter, Costa Mesa, California, May.
- S. Hayes, J. Hower, and M. Scott. 2003. Profit from effective greenhouse gas management – a six-step plan. American Institute of Chemical Engineers, *CEP*, 36-43, May.
- S. Hayes. 2002. Proposition 65: exposure to airborne emissions. Presented at conference on "Understanding How Proposition 65 Affects Your Business," Nossamen, Guthner, Knox & Elliot et al., San Francisco, California, March.

Stanley R. Hayes

- M. Scott and S. Hayes. 2002. Managing greenhouse gas emissions: expanding corporate challenges and sizing up the credit risks. Presented at Environmental Bankers Association Meeting, San Diego, California, January.
- S. Hayes, M. Scott, J. Hower, and S. Hardy. 2002. Managing GHG (greenhouse gas) emissions: an action plan. Air & Waste Management Association, *EM*, 26-34, January.
- S. Mann and S. Hayes. 2001. Development and analysis of a residual risk assessment database. Paper #368. Presented at 94th Annual Meeting, Air & Waste Management Association, Orlando, Florida, June.
- D. Daugherty and S. Hayes. 2001. Screening-level risk analyses of fluid catalytic cracking units at twenty-five refineries. Paper #504. Presented at 94th Annual Meeting, Air & Waste Management Association, Orlando, Florida, June.
- S.R. Hayes and J.R. Marshall. 1999. Designing optimal strategies to attain the new U.S. particulate standards: some initial concepts. *J. Air & Waste Manage. Assoc.*, **49**: PM-192-198.
- S. Hayes. 1999. Air quality control: some scientific considerations. Presented at Legislative Briefing Seminar on Air Quality, Water and Public Infrastructure, California Foundation on the Environment and the Economy, Napa, March.
- S. Hayes and J. Marshall. 1998. Development of an exposure-based strategy for attaining U.S. particulate standards. Paper 98-MP26.05. Presented at 91st Annual Meeting, Air & Waste Management Association, San Diego, California, June.
- S. Hayes and J. Marshall. 1998. Designing optimal strategies to attain the new U.S. particulate standards: some initial concepts. Presented at "PM2.5: A Fine Particle Standard" International Specialty Conference, Air & Waste Management Association and U.S. Environmental Protection Agency, Long Beach, California, January.
- S. Hayes and S. Pye. 1997. Exposure and health risk considerations in setting new U.S. particulate standards. Paper 97-MP9.05. Invited paper, presented at 90th Annual Meeting, Air & Waste Management Association, Toronto, Canada, June.
- S. Hayes. 1997. Comparative health protection of alternative U.S. ozone standards. Invited paper, presented at Society of Automotive Engineers Government/Industry Meeting, Washington, D.C., May.
- S. Hayes. 1997. Air quality considerations in electric industry restructuring. Presented at National Conference of State Legislatures, Assembly on State Issues/Spring 1997, San Francisco, April.
- S. Hayes. 1997. Particulate matter: some scientific considerations. Presented at Legislative Briefing Seminar on Energy Issues and Air Quality, California Foundation on the Environment and the Economy, Napa, March.
- S. Hayes, A. Stuart, S. Pye, L. Levin, and J. Killus. 1996. Assessing exposure to airborne particulate matter. Paper 96-WA68.06. Invited paper, presented at 89th Annual Meeting, Air & Waste Management Association, Nashville, June.

Stanley R. Hayes

- S. Hayes. 1995. Toward greater realism in air toxics exposure assessment. Paper A767. Invited paper, presented at 88th Annual Meeting, Air & Waste Management Association, San Antonio, June.
- S. Hayes, S. Pye, and L. Levin. 1994. Sensitivity analysis of a Monte Carlo exposure assessment model for acidic aerosols and gases. Paper A766. Invited paper, presented at 87th Annual Meeting, Air & Waste Management Association, Cincinnati, June.
- R.G. Whitfield, H.M. Richmond, S.R. Hayes, A.S. Rosenbaum, T.S. Wallsten, R.L. Winkler, M.L.G. Absil, and P. Narducci. 1994. *Chapter 5, Health Risk Assessment of Ozone*. In: *Ozone: Effects on Public Health and Ecological Impacts, Why Society Must Control Tropospheric Ozone*, ed., D.J. McKee. Chelsea, Michigan: Lewis Publishers.
- S. Hayes. 1993. Air toxics risk assessment in California - How certain are we about true environmental risks? Presenter and moderator, panel discussion, 4th Annual Issues in Air Toxics, Air & Waste Management Association, Sacramento, November.
- S. Hayes and J. Westbrook. 1993. Analysis of environmental regulatory requirements for petroleum companies. Invited paper, California Petroleum Industry Environmental Workshop, Bakersfield, November.
- R.L. Winkler, T.S. Wallsten, R.G. Whitfield, H.M. Richmond, S.R. Hayes, and A.S. Rosenbaum. 1993. An assessment of the risk of chronic lung injury attributable to long-term ozone exposure. Accepted for publication, *Operations Research*, September.
- S. Hayes, J. Wilhelmi, S. Pye, L. Gates, and L. Levin. 1993. Development of a modeling methodology for assessing exposure to acidic aerosols and gases. Paper A1394. Invited paper, presented at 86th Annual Meeting, Air & Waste Management Association, Denver, June.
- S. Hayes and J. Wilhelmi. 1993. Monte Carlo exposure assessment using the Air Toxics Exposure Model (ATEX). Paper A1391. Invited paper, presented at 86th Annual Meeting, Air & Waste Management Association, Denver, June.
- S. Hayes and J. Wilhelmi. 1992. Use of probabilistic Monte Carlo techniques in air toxics exposure assessment. Presented at Third Annual Conference on Current Issues in Air Toxics, Air & Waste Management Association, Sacramento, November.
- S. Hayes and R. Harris. 1992. Monte Carlo techniques in air toxics exposure assessment. Invited paper, Presented at 1992 Annual Meeting, Society for Risk Analysis, San Diego, December.
- S. Hayes. 1991. Addressing indoor/outdoor differences and population activity/mobility in air toxics risk decisions. Paper 91-170.9. Invited paper for presentation at the 84th Annual Meeting, Air & Waste Management Association, Vancouver, June.
- S. Hayes and J. Bradstreet. 1991. Air toxics and the new Clean Air Act. *ENVIRON Report*, pp. 5-9, Winter 1991.
- S. Hayes. 1991. Use of an indoor air quality model (IAQM) to estimate ozone levels indoors. *J. Air & Waste Manage. Assoc.*, **41**(2):161-170.

Stanley R. Hayes

- S. Hayes. 1991. Exposures via the air. Presented at CEEM Conference on Risk Assessment and Its Uses in Environmental Regulations, Ballston, Virginia, November.
- S. Hayes. 1991. Incorporating indoor/outdoor differences and population activity/mobility patterns into air toxics risk assessment. Presented at Air & Waste Management Association Conference on Current Issues in Air Toxics, Sacramento, October.
- B.R. Weir, G.E. Anderson, S.R. Hayes, and S.M. Greenfield. 1990. Specification of indoor air model characteristics. *Indoor Air '90*, Montreal, August.
- T.S. Wallsten, H.M. Richmond, R.G. Whitfield, A.S. Rosenbaum, S.R. Hayes, and R.L. Winkler. 1990. Chronic lung injury risk assessment for ozone. Paper 90-150.7 presented by Wallsten at the 83rd Annual Meeting & Exhibition, Air & Waste Management Association, Pittsburgh, June.
- R.L. Winkler, R.G. Whitfield, T.S. Wallsten, S.R. Hayes, A.S. Rosenbaum, and H.M. Richmond. 1990. Health risk due to ozone chronic lung injury: An assessment of expert judgments. Invited paper presented by Hayes at the Specialty Conference on Tropospheric Ozone and the Environment, Air & Waste Management Association, Los Angeles, March.
- G.E. Anderson, A.S. Rosenbaum, S.R. Hayes, and G.W. Lundberg. 1990. Development of a multipathway human exposure model for toxics in the South Coast Air Basin. Paper presented at the 1990 EPA/AWMA Symposium on Total Exposure Assessment Methodology, Las Vegas, November.
- S.R. Hayes, A.S. Rosenbaum, and H. Richmond. 1989. Ozone risk assessment implementation: Transferring risk analysis technology to ozone nonattainment planning. Paper MPM-J4 presented at the Annual Meeting, Society for Risk Analysis, San Francisco, November.
- S.R. Hayes and A.S. Rosenbaum. 1989. Application of an urban-scale population exposure model (NEM/SAI) to ozone risk assessment. Paper WAM-B3 presented at the Annual Meeting, Society for Risk Analysis, San Francisco, November.
- S.R. Hayes and A.S. Rosenbaum. 1989. Acute ozone exposure-response relationships for use in ozone risk assessment. Paper MPM-J3 presented at the Annual Meeting, Society for Risk Analysis, San Francisco, November.
- S.R. Hayes. 1989. Estimating the effect of being indoors on total personal exposure to outdoor air pollution. *JAPCA* **39**(11):1453-1461.
- S.R. Hayes, A.S. Rosenbaum, and B.S. Austin. 1989. Assessing the effect of ozone nonattainment plans on acute ozone exposure and health risk. Paper No. 89-027.007 in *Proc. 82nd Annual Meeting, Air & Waste Manage. Assoc.*, Anaheim, California, June.
- S.R. Hayes, A.S. Rosenbaum, T.S. Wallsten, R.L. Winkler, R.G. Whitfield, and H. Richmond. 1989. A health risk assessment for use in setting the U.S. primary ozone standard. In *Atmospheric Ozone Research and Its Policy Implications*, T. Schneider and S. Lee, eds. Amsterdam, The Netherlands: Elsevier Science Publishers; 1988. Invited paper presented at the Third US-Dutch International Symposium, Nijmegen, The Netherlands, May.

Stanley R. Hayes

- G.E. Anderson and S.R. Hayes. 1988. The effect of population mobility on urban human health risk from emissions from an industrial stack. Paper 88-128.7 in *Proc. 81st Annual Meeting, Air Pollut. Control Assoc.*, Dallas, June.
- S.R. Hayes et al. 1987. Assessing pulmonary function and symptom health risks associated with ozone exposure: A summary of recent progress. Paper 87-43.4 in *Proc. 80th Annual Meeting, Air Pollut. Control Assoc.*, New York, June.
- S.R. Hayes and G.E. Moore. 1986. Air quality model performance: A comparative analysis of 15 model evaluation studies. *Atmos. Environ.*, 20(10):1897-1911; 1985. Paper prepared for the International Conference on Atmospheric Sciences and Applications to Air Quality, Seoul, Korea, May.
- S.R. Hayes and G.E. Moore. 1985. Air quality model performance: A comparative analysis of model evaluation studies and their implications. In *Proc. 78th Annual Meeting, Air Pollut. Control Assoc.*, Detroit, June.
- S.R. Hayes, C. Seigneur, and G.W. Lundberg. 1985. Numerical modeling of ozone population exposure: Application of a photochemical model. Paper 85-23.6 in *Proc. 78th Annual Meeting, Air Pollut. Control Assoc.*, Detroit, June.
- S.R. Hayes, J.L. Haney, and C.S. Burton. 1984. An evaluation of several alternative formulations of the national ambient air quality standards for SO₂. Paper 84-109.2 in *Proc. 77th Annual Meeting, Air Pollut. Control Assoc.*, San Francisco, June.
- S.R. Hayes. 1982. An uncertainty analysis of EKMA-derived control requirements for ozone and nitrogen dioxide abatement. Paper 82-20.5 in *Proc. 75th Annual Meeting, Air Pollut. Control Assoc.*, New Orleans, June.
- J.P. Killus, G.E. Anderson, and S.R. Hayes. 1981. Simulation of ozone formation in Denver, Colorado, using a photochemical grid model. Paper presented to the American Meteorological Society, Oregon Chapter.
- S.R. Hayes. 1980. The use of a computer terrain model in plume visibility analysis. Paper presented at the Symposium on Plumes and Visibility: Measurements and Model Components, Grand Canyon, Arizona, November.
- S.R. Hayes. 1979. A technique for plume visualization in power plant siting. *J. Air Pollut. Control Assoc.* 29(8):840-843, August.
- S.R. Hayes. 1979. The changing regulatory environment: An appraisal of model needs in the analysis and examination of potential air quality impacts of NO_x emissions from large point sources. In *Proc. 10th International Technical Meeting on Air Pollution Modeling and Its Application*, NATO/CCMS, Rome, October.
- S.R. Hayes. 1978. A consideration of measures and standards of performance of air quality simulation models. In *Proc. Ninth Meeting of the Expert Panel on Air Pollution Modeling*, NATO/CCMS, Toronto, Canada.

Attachment B

**Deposition and Court Testimony of
Stanley R. Hayes**

DEPOSITION AND COURT TESTIMONY

Stanley R. Hayes

Since January 1, 1995, Mr. Hayes has given trial or hearing testimony and/or been deposed in the following cases.

1. Amelia Garza, et al. vs. Amerada Hess, et al., No. 93-3348-A, In the 28th Judicial District Court of Nueces County, State of Texas (Corpus Christi)
 - Deposition (October 16, 1996)
2. Alana Burke, et al. vs. La Paz Compania Naviera, S.A., et al., No. 26392, In the 40th Judicial District Court, Division C, Parish of St. John the Baptist, State of Louisiana (Gramercy)
 - Trial testimony (October 7, 1997)
 - Deposition (September 10-11, 1997)
3. Elsie A. Abel, et al. vs. Lockheed Martin Corporation, et al., Case No. EC 021023 (Consolidated with Case Nos. EC 021110; EC 021463; EC 021931), In Superior Court, County of Los Angeles, State of California (Los Angeles)
 - Kelly Frye hearing testimony (March 27-28, 2000)
 - Deposition (February 8, 1999)
4. Burbank Environmental Litigation, Master File No. 96-5584 MRP (Anx), In the United States District Court, Central District of California (Burbank)
 - Deposition (April 20, 1999)
5. Charles D. Jones, et al. vs. Minnesota Mining & Manufacturing Co., Larry Meyers, No. CV-98-8693, In the Circuit Court of Pulaski County, Arkansas, Fifth Division (Little Rock)
 - Deposition (January 4, 2000)
6. Virgie Adams and Charles Adams vs. American Ecology Environmental Services Corporation, et al., Cause No. 236-165224-96, In the 236th Judicial District Court, Tarrant County, Texas (Tyler)
 - Deposition (July 20, 2000)
7. Charlie Casas, et al. vs. Hoechst Celanese Chemical, et al., Cause No. 97-00418-1, In the 162nd Judicial District Court, Dallas County, Texas (Pampa)

- Deposition (December 11 and 18, 2002)
- 8. Herman Barfield, et al. vs. SST Truck Company, Cause No. 01-02786-C, In the 68th Judicial District Court, Dallas County, Texas (Dallas)
 - Trial testimony (September 23, 2004)
 - Deposition (November 14, 2002)
- 9. Mary Nicola, et al. vs. Edward Filbin, et al., No. CV 801282, In re: Westley Tire Fire Litigation, In Superior Court, Santa Clara County, State of California (Santa Clara)
 - Deposition (March 9 and May 25, 2005)
- 10. Lawrence O'Connor, et al. vs. Boeing North American, Inc., et al., Case No. CV 97-1554 DT (RCx), In the United States District Court, Western Division of California
 - Deposition (June 8, 2005)
- 11. Association of American Railroads, et al. vs. South Coast Air Quality Management District, et al., Case No. CV 06-1416 JFW (PLAx), In the United States District Court, Central District of California (Los Angeles)
 - Trial testimony (November 29, 2006)
 - Deposition (November 1, 2006)
- 12. United States of America and State of New York, et al. vs. American Electric Power Service Corp., et al., Case Nos. 2:99-CV-1182 & 99-CV-1250, In the United States District Court, Southern District of Ohio, Eastern Division
 - Deposition (January 4 and February 27, 2007)
- 13. Michael Ancar, et al., vs. Murphy Oil U.S.A., Inc., et al., Case No. 06-CV-3246, In the United States District Court, Eastern District of Louisiana
 - Deposition (September 13, 2007)
- 14. Ponca Tribe of Indians of Oklahoma, et al., Plaintiffs, vs. Continental Carbon Company, et al., Defendants / Third-Party Plaintiffs, vs. Conoco Phillips, Third-Party Defendant, Case No. CIV-05-445-C, Certified Class Action, In the United States District Court, Western District of Oklahoma
 - Deposition (June 11, 2008)

15. United States of America, et al. v. Cinergy Corp., et al., Civil Action No. IP99-1693 C/MS, Action, In the United States District Court, Southern District of Indiana, Indianapolis Division
 - Trial testimony, Remedy Phase (February 4, 2009)
 - Deposition (October 30, 2008)